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AS AD No. _____

hallicrafters

MONTHLY PROGRESS REPORT NO. 4

JAMMER EVALUATOR
QRC-184(T)

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MONTHLY PROGRESS REPORT NO. 4

ON

JAMMER EVALUATOR

QRC-184(T)

CONTRACT NO. AF33(657)-9312

TASK NO. BPAC 6799-56A-4700

Period Covering

25 September 1962 to 25 October 1962

The Hallicrafters Company
5th and Kostner Avenues
Chicago 24, Illinois

DATE: 29 October 1962
HLC NO.: 094-903365
COPY NO.: 35

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ON

JAMMER EVALUATOR QRC-184(T)

CONTRACT NO. AF33(657)-9312

TASK NO. BPAC6799-560A-4700

I. GENERAL REQUIREMENTS

Contract NO. AF33(657)-9312, initiated 12 June 1962, requires The Hallicrafters to furnish and deliver one (1) QRC-184(T) Jammer Evaluator as outlined in Section II of this report. A fully executed copy of the contract was received by the Contractor on 25 June 1962.

II. DETAILED REQUIREMENTS

The detailed requirements of Contract AF33(657)-9312 as outlined in paragraphs A to D in accordance with Exhibit "A" of the letter contract are as follows:

A. Items to Be Furnished

(a) The Contractor shall furnish the items listed below:

(1) One (1) S-Band RF plug-in unit designed, tested, and manufactured in accordance with Exhibit "A".

(2) One (1) P-Band RF plug-in unit designed, tested, and manufactured in accordance with Exhibit "A".

(3) One (1) Control Unit designed, tested and manufactured in accordance with Exhibit "A".

(4) One (1) Type 535 Tektronix Oscilloscope with type B plug-in pre-amplifier or equivalent.

(5) Two (2) Operation and Maintenance Instruction Manuals including parts list.

(6) One (1) Auxiliary equipment consisting of RF loads and coaxial cables.

(7) Reserved.

(8) Monthly Progress Reports, distributed in accordance with the standard QRC list.

(9) Final Engineering Reports distributed in accordance with the standard QRC list.

(10) Two man-months of domestic engineering services to be furnished in support of ASD evaluations.

(b) Preserving, packaging, packing, and marking the supplies called for above shall be in accordance with Contractor's Standard Commercial Practice.

NOTE

The rights obtained by the Government in the Subject Data are set forth in the Data Clause incorporated in the contract and nothing elsewhere in the contract or in any documents incorporated by reference in the Contract shall be construed as in any way altering such rights.

(c) Contractor agrees to mark the number of the Contract on all Data delivered hereunder.

(d) Reproduction of reports shall be by a method that is not printing as defined in the printing and binding regulations published by the Congressional Joint Committee on Printing.

(e) Any reports submitted in compliance with the contract for the use of any activity of the Government shall bear the Contract number and task number. In the event any reports are required to be furnished to the Government under the contract the contractor shall mail a copy of the forwarding document (letter of transmittal) to the office having administration responsibility for the contract.

B. Delivery

(a) The contractor shall deliver the supplies and perform the services called for hereunder in accordance with the following schedule. Items 1, 2, 3, 4, 5, and 6. Within seven months after receipt by the Contractor of a fully executed copy of the contract.

Item 7 - Reserved.

Item 8 - During the course of the Contract beginning 30 days following receipt by the Contractor of a fully executed copy of the contract.

Item 9 - Within 30 days after delivery of items 1, 2, 3, 4, 5, and 6.

Item 10 - Upon request by the ASD Project Engineer but subsequent to delivery of items 1, 2, 3, 4, 5, and 6.

(b) Request for consignment instructions for herein shall be made to:

AFSC Aeronautical Systems Division
ATTN: ASNPVD-1
Wright-Patterson
Air Force Base, Ohio

C. Inspection and Acceptance

Preliminary inspection of the supplies called for under Items 1, 2, 3, 4, and 6 shall be conducted by the ASD Project Engineer at the Hallicrafters Plant in Chicago, Illinois.

Final inspection and acceptance of items 1, 2, 3, 4, and 6 shall be at the place of destination. Wright-Patterson Air Force Base, Ohio (ASNPVD-1). Supplies called for under Items 5, 8, 9, and 10 shall be inspected and accepted by the Government at the place of destination.

D. Technical Requirements

1. This section outlines the requirements of the QRC-185(T) Jamming Evaluator which will consist of two (2) different RF plug-in heads and a control unit. Either RF plug-in unit, when mechanically joined with the control, will form a single unit which in dimensions to the AN/ALT-13(V) transmitter. RF plug-in will contain all the radio frequency sensitive elements. The control unit will contain all the components and circuitry necessary to produce the necessary displays on an auxiliary oscilloscope. The control unit will provide the flexibility to accept different RF heads. This configuration will allow the frequency range of the QRC-184(T) to be extended with a minimum of expense. An oscilloscope will also be provided for display purposes.

   The technique incorporated in the QRC-184(T) shall be, essentially, electronically scanning or switching the various filter networks at a given commutation rate so that output signals from these filters may be appropriately processed and made available as input signals to an oscilloscope for display purposes.

2. Technical requirements of the S-Band unit when used in conjunction with the control unit.

   a. Frequency Coverage:

      2400 MC to 3650 MC using 125 channels each 10 MC wide.

   b. Display:

      The QRC-184(T) shall produce a panoramic type display on an auxiliary oscilloscope which indicates the distribution of RF power as a function of RF frequency.

c. RF Power Measurement:

The QRC-184(T) shall measure the RF power density of the signal under test within an accuracy of plus or minus 15 percent.

d. RF Frequency Measurement:

Two variable frequency markers shall be provided which indicate the center frequencies of the various 10 MC channels to an accuracy of plus or minus 2 MC.

e. Sensitivity:

A signal with an average power density of 0.5 watts/MC shall produce a full-scale deflection of the oscilloscope trace.

f. Dynamic Range:

The dynamic range shall be 20 DB.

g. Resolution:

The resolution shall be 10 MC.

h. Commutation Rate:

All channels shall be sampled thirty times per second.

i. Trigger and Unblanking Output:

Positive trigger pulses shall be provided to synchronize the oscilloscope sweep. Unblanking pulses shall be provided to intensity-modulate the oscilloscope trace to produce a dot pattern (power versus frequency) and frequency markers.

j. Power Requirements:

The input power to QRC-184(T) shall be 115 ±10 VAC 60 ±3 CPS single-phase, approximately 2 amperes.

k. Size:

No "Mil-specs" shall apply to the over-all dimensions. However, it shall be possible to physically place the QRC-184(T) in an AN/ALT-13 type mounting base (for aircraft installation purposes).

l. Weight:

The design objective shall be 100 pounds maximum.

m. Temperature:

The performance cited herein shall be met when the equipment is operated within an ambient temperature range 30° F to 100° F.

n. Test Equipment:

The oscilloscope to be used for display purposes will be a Tektronix type 535 with type B plug-in pre-amplifier or equivalent.

3. Technical requirements of the P-Band unit when used in conjunction with the control unit.

a. Frequency Coverage:

480 MC to 1020 MC using 108 channels each 5 MC wide.

b. Display:

Same as S-Band.

c. RF Power Measurement:

Same as S-Band.

d. RF Frequency Measurement:

Two (2) variable frequency markers shall be provided which indicate the center frequencies of the various 5 MC channels to an accuracy of plus or minus 2 MC.

e. Sensitivity:

A signal with an average power density of 1.0 watt/MC shall produce a full-scale deflection on the oscilloscope trace.

f. Dynamic Range:

Same as S-Band.

g. Resolution:

The resolution shall be 5 MC.

h. Commutation Rate:

Same as S-Band.

i. Trigger and Unblanking:

Same as S-Band.

j. Power Requirements:

Same as S-Band.

k. Size:

Same requirements as S-Band but not necessarily the same dimensions as the S-Band Unit.

l. Weight:

The design objective shall be 120 pounds maximum.

m. Temperature:

Same as S-Band.

n. Test Equipment:

The same (one) oscilloscope cited in paragraph 2.n. shall be used for display purposes.

4. Auxiliary Equipment:

The following auxiliary equipment is required but is not considered an integral part of the QRC-184(T). Likewise, this equipment need not be packaged in the QRC-184(T) form factor.

a. RF Load:

500-watt capability, 2400 MC to 3650 MC minimum frequency range, female LT-Type connector.

b. RF Load:

500-watt capability, 480 MC to 1020 MC minimum frequency range, female LT-Type Connector.

c. Cables:

Four each coaxial cables, type RG-117b or equivalent, with male LT-Type fittings on both ends. Length - approximately 3 feet.

d. Cables:

Six each coaxial cables, type RG-58C/U or equivalent, with type UG-88C/U fittings on one end. Length - approximately 3 feet. The other ends shall be terminated in a suitable manner for making connection to the particular type of oscilloscope being employed.

III. PAST PROGRESS

During the last reporting period the major effort was directed toward the design of the P-Band RF filters. As has been previously reported suitable Q's have been achieved over approximately three-quarters of the band of interest (low end) using coaxial resonators with helical inner conductors, capacitance-tuned.

The helical resonator is a coil operating at its lowest self-resonance, electrically equivalent to a quarter-wave section of transmission line.

The region where straight coaxial resonators are preferable is separated from that where the use of a helical inner conductor is desirable by a rather broad transition zone. The choice is affected by the shape factor. A coaxial resonator is long and relatively small in diameter. In the helical resonator the length is not much greater than its diameter. A resonator with about three turns (N = 3) lies within the transition zone. This number, (N = 3), can be derived from either of two basic concepts. The first is the locus of points where equal unloaded Q versus frequency is obtained with the two types of resonators having equal volumes. The second basic concept is the limitation that $Y < d/2$, or the pitch of the helix be less than its radius, otherwise it almost ceases to be helical.

On the basis of measurements of the resonance frequency and characteristic impedance of various resonators, it appears that the effective capacitance is somewhat greater than that of two simple coaxial cylinders. Also, the electrical length of the helix is 5 to 7 percent less than quarter-wavelength. These are attributed in part to the self capacitance of the coil and the fringing field at the top of the coil.

The capacitance tuned resonators, using piston trimmers, proved to be inadequate at the upper frequency portion of the spectrum of interest. The minimum residual capacitance of the tuning capacitor requires that the turns of the helix be reduced to less than the desired minimum number (N = 3) for a helical type resonator. Also at the high frequencies losses of the tuning capacitor reduces the Q's of the resonator so that it becomes difficult to maintain the desired bandwidth without increasing the cavity diameter to a point that would be objectionable from an over-all filter size consideration.

However, by using inductively tuned helices and by allowing one end of the coil to be open-circuited, the entire band of interest has been covered with the helices at the upper frequencies having the desired 3 to 4 turns (N = 3 to 4). Also by altering the shield (cavity) from a circular to a square configuration, an increase in the unloaded Q was obtained. A bank of 22 channels was in the process of construction. This bank will be used for further evaluation of stability, ease of adjustment, insertion losses, etc., over the entire spectrum of interest.

IV. CURRENT PROGRESS

During this reporting period the construction of the first bank of P-Band RF filters was completed. This bank consists of 22 channels, each of which is 5 MC wide. Figure 1 is a photograph of this bank and is included here to show the

construction technique. The P-Band RF head will contain five such banks interconnected by coaxial cables. This will result in a total of 109 channels covering the band from 480 MC to 1020 MC (the last bank in the string will contain only 21 channels).

Electrical tests were performed on this first bank with satisfactory results and construction of the four additional banks required to cover the complete frequency range was started.

Temperature tests on the first bank showed that the de-tuning effects are negligible. As expected the detectors, which are in the outputs of each of the channels, exhibited a wide variation in voltage output due to the temperature changes. Based upon the data obtained, the design of a temperature control system has been initiated, the purpose of which is to maintain detectors at a relatively constant temperature over wide variations of ambient temperature. Basically the temperature control system will consist of suitably placed electrical heating elements with thermostatic controls.

V. PROGRAM FOR THE NEXT INTERVAL

Complete the mechanical design of the P-Band RF head plug-in chassis. Align and test the complete RF filter assembly.

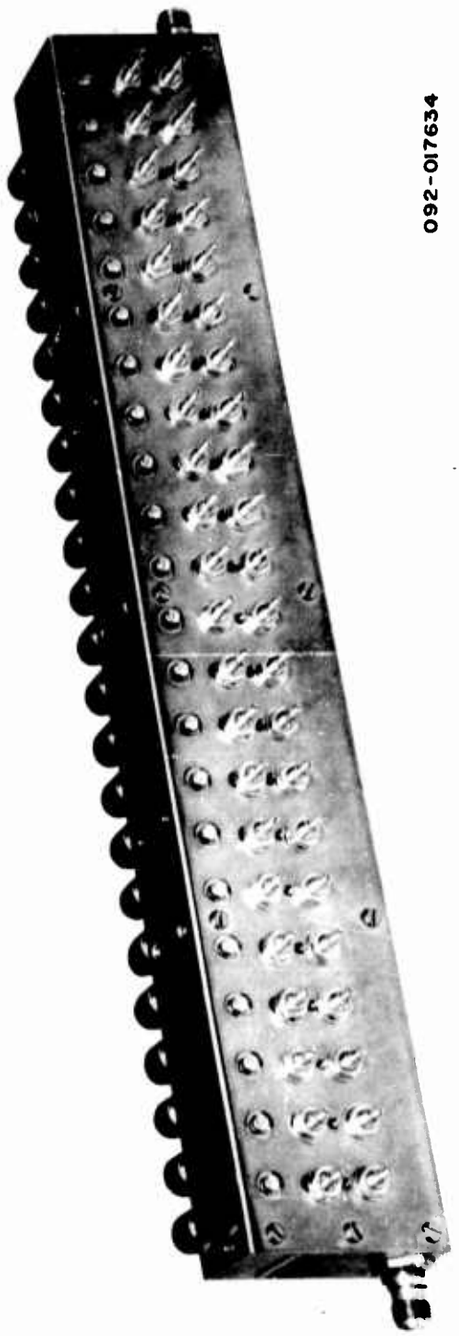

Figure 1. 22 Channel Filter Bank.

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